

**National Aeronautics and Space Administration**

**Office of Space Science**

**SPACE SCIENCE ADVISORY COMMITTEE**

**March 25–26, 2004**

**Grand Hyatt at the Washington Center  
1000 H Street, N.W.  
Washington, D.C.**

**MEETING REPORT**

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**Marc S. Allen**  
Executive Secretary

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**Andrew B. Christensen**  
Chair

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)**

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*Thursday, March 25, 2004*Welcome and Opening Remarks

Dr. Andrew Christensen, chair of the Space Science Advisory Committee (SScAC), welcomed the members and visitors. He then acknowledged the service to the committee of those members present whose terms are expiring after this meeting. Dr. Marc Allen, Executive Secretary of the SScAC, announced logistical details for the meeting and explained that the scheduled discussion of the Explorer Program was postponed until the July meeting in order to address the issue of potential conflicts of interest of committee members on this topic.

Program Overview and Status Briefing

Dr. Edward Weiler, NASA Associate Administrator for Space Science, briefed the SScAC on the President's Space Exploration Vision and the status of programs and missions in the Space Science Enterprise. On January 14, 2004, the President announced a new vision for NASA, under which NASA will implement a sustained and affordable human and robotic program to explore the solar system and beyond. The vision includes extending a human presence across the solar system, starting with a human return to the Moon by the year 2020 in preparation for human exploration of Mars and other destinations. This exploration will be guided by compelling questions of scientific and societal importance. Dr. Weiler described the key elements of the Exploration Initiative with respect to lunar exploration, Mars exploration, and other exploration programs in the solar system and beyond. If approved by Congress as proposed, the Exploration Initiative will increase NASA's budget beginning in FY 2005, with \$12 billion in new funding through FY 2009. Without it, there would be a decrease in FY 2005 and no increase thereafter. In addition to a 5 percent increase per year for the next three years, the exploration programs will be funded by reallocation of resources from retiring the Shuttle, realigning existing programs, and focusing on technological innovations that reduce the cost of sustained space operations.

No Office of Space Science (Code S) projects will be cancelled, but some will be delayed by the reallocation of resources. Three existing budget themes in Code S—the Solar System Exploration (SSE) and Astronomical Search for Origins (ASO) themes and the Mars Exploration Program (MEP)—are viewed as exploration programs, as is the new Lunar Exploration Program (LEP) in Code S. The Sun-Earth Connections (SEC) and Structure and Evolution of the Universe (SEU) themes will be reduced and refocused. Funds added to support the next decade of Mars exploration include an additional Scout mission in 2011, a Mars Test Bed Lander in 2011, technology for post-2010 Mars science pathways, and technology for post-2013 Mars Test Beds. In the SEU theme, the Laser Interferometer Space Antenna (LISA) is delayed by one year, Constellation X is delayed by 2 years, and the Einstein Probes are deferred beyond 2009. In the SEC theme, the Solar Terrestrial Probes (STP) line will be stretched out in time. Future medium-class Explorer (MIDEX) missions will be delayed by as much as 2 years. The Living With a Star program (LWS) was fully funded. Options for the Explorer Program will be discussed at the July SScAC meeting.

The NASA Administrator canceled a fourth Shuttle servicing mission to the Hubble Space Telescope (HST) for reasons of astronaut safety and overall risk. Extension of HST's operational life without additional servicing will be studied. Proposals have been received in response to a

Request for Information (RFI) on HST servicing options. A National Research Council (NRC) review of these proposals will include engineering and safety expertise, as well as scientific expertise. HST de-orbit will be via an autonomous rendezvous mission. The funding profile for the James Webb Space Telescope (JWST) will be augmented to restore the project's original schedule.

The Nuclear Electric Propulsion (NEP) and related technology development activities of Project Prometheus were transferred to the new Office of Exploration Systems (Code T). The work on radioisotope power systems (RPSs) and Jupiter Icy Moons Orbiter (JIMO) fundamental science and instruments remains in Code S, although no funding is identified yet for JIMO instrument development beyond phase A.

The LEP, which will take its requirements from Code T and the Office of Biological and Physical Research (Code U), will be driven by exploration objectives rather than science objectives. The first LEP mission will be a Lunar Reconnaissance Orbiter (LRO) launched in 2008. The second mission will be a robotic lander, potentially a rover. Instrument Announcements of Opportunity (AOs) will be directed at acquiring instruments to meet defined mission requirements. A lunar data analysis program will be initiated, with data probably being archived in the Planetary Data System (PDS).

The MEP will be significantly augmented. There will be an additional Scout mission in 2011 and a new Mars Test Bed Lander in 2011. The Mars Test Bed program will be directed toward preparing for a human landing on Mars, in line with the National Academies report, *Safe on Mars*, and toward *in situ* resource utilization. A Mars sample return (MSR) mission may be launched as early as 2013. The science vision for MEP is unchanged. Another augmentation to the MEP is the addition of Trailblazer missions, which are additional robotic missions and technologies targeted to the program goal of preparing for future human exploration. This series of landed missions will be designed to satisfy requirements defined by Code T.

Dr. Weiler summarized the status of current missions and projects in Code S. The first science results from the Spitzer Space Telescope will appear later this year in an *Astrophysics Journal Supplement*. In calendar 2004 to date, the NASA websites have received 9 billion hits, with 20 percent of these from students in kindergarten through high school (K-12). The primary missions for the Mars Exploration Rovers (MERs) end in April; their extended missions are likely to continue into June. The proportion of MER data (86 percent) that has been relayed by Mars Global Surveyor (MGS) and Odyssey illustrates the value of a dedicated telecommunications orbiter to support future Mars surface missions. Launch of the Mercury Surface, Space Environment, Geochemistry and Ranging mission (MESSENGER) has been delayed from May to the July-August launch window because of significant engineering problems. Genesis sample return will occur on September 8. Dr. Weiler summarized other major mission events during 2004 and outyears.

During the question period, Dr. Weiler responded to questions about cancellation of the HST servicing mission, the "safe haven" requirement for the Shuttle as a developmental vehicle, and his strategy for regaining funding for the Beyond Einstein and Solar Probe missions. The investment in the HST instruments that were to fly on SM-4 could be recovered by offering them as Government-Furnished Equipment (GFE) for an Explorer mission. The SScAC and Dr. Weiler discussed the newly appointed President's Commission on Implementation of United States Space Exploration Policy (Aldridge Commission), the commission's charter relative to Exploration Initiative objectives, and ways in which the SScAC could communicate its perspective to the Commission. Dr. Weiler noted that the Aldridge Commission is chartered to

comment on how to implement the President's vision, not to advise on the vision's goals. His approach to keeping the science in the exploration vision is to advocate that science must inform the vision in order for the vision to last.

#### Division Reports

The SScAC heard status briefings from the Directors of the Astronomy and Physics Division (APD), Solar System Exploration Division (SSED), and Sun-Earth Connections Division (SECD).

**APD Status Update.** Dr. Anne Kinney, APD Director, began with science highlights from the APD operating missions, including Chandra x-ray pictures of Saturn, Spitzer Space Telescope images of star formation, and details from the Hubble Ultra Deep Field images captured with the Advanced Camera for Surveys (ACS). All operating missions have *green* status. In the past 12 months, APD missions have been the source of science discoveries presented in six NASA Space Science Updates and media teleconferences. Roadmapping in the APD themes, which is beginning its next round, will be done in the context of the new NASA vision.

Among significant events in the ASO theme's developmental missions were completion of Science Requirements Reviews for the Space Interferometry Mission (SIM) and JWST, the SM-4 cancellation, and the shift in the JWST funding profile. Within NASA, the science value of SM-4 was emphasized all the way up to the NASA Advisory Council (NAC); the decision was based on safety, not science potential. Dr. Kinney summarized the actions being taken to operate HST in ways that extend its useful lifetime and optimize the science return. The first flight of the Stratospheric Observatory for Infrared Astronomy (SOFIA) has been delayed by problems with the fuselage door. The Keck Interferometer project status is *yellow* on technical issues with the nuller and *red* on legal issues related to environmental permitting. Planning for the Terrestrial Planet Finder (TPF) mission is being adjusted to align with the Exploration Initiative. A NASA Research Announcement (NRA) for ASO vision missions has been released.

Among developmental missions in the SEU theme, the Gamma ray Large Area Space Telescope (GLAST) project passed confirmation review to enter phase D, but has some technical problems. While the President's FY 2005 budget delayed the Beyond Einstein program, it added funding for GLAST, Gravity Probe-B (GP-B), and the Swift Gamma Ray Burst Explorer (Swift). GP-B remains on schedule for an April 17 launch. Swift has an image processor problem, which has delayed launch, but a solution seems to be in hand.

Following up on the SScAC's concerns about how contracts are awarded for major science centers, Dr. Kinney reviewed the status and level of effort parameters for the four science centers funded within the Office of Science. An agreement with the National Science Foundation (NSF) will make Keck Interferometer data available from the Michelson Science Center after 1 year.

**SSED Status Update.** Dr. Jay Bergstralh, SSE Associate Director for Research and Analysis, gave the presentation for Orlando Figueroa. He traced the implications for SSED themes and programs of the 2005 President's budget request and the Exploration Initiative. The lunar exploration activities within SSED will be under the Robotic Lunar Program (RLP). The Mars Test Bed and Mars Trailblazer missions, along with related technology development, will be under the MEP, which is now under SSED. The budget wedge for planning the Next Decade of Mars exploration has been restored. The RPS Technology and Project Prometheus/JIMO science activities from Project Prometheus were transferred to SSED when the rest of Project Prometheus was transferred to Code T. The new SSED organization will include program directors for the

MEP and RLP. The three themes under this new SSED organization will be Solar System Exploration, the Mars Exploration, and Robotic Lunar Exploration.

The new round of SSED roadmapping will address four objectives of the new NASA vision: (1) setting the context for exploration and the search for life, (2) assessment of environments, (3) safety and identification of potential resources, and (4) development, infusion, and validation of relevant technologies.

Among the SSED operating missions, Cassini is preparing for arrival at Saturn in July 2004, with no major technical issues to be resolved. The first Saturn approach science sequence began execution on January 9. Stardust has closed its collectors and is heading back to Earth rendezvous for sample return. The images returned from Stardust show that the target comet nucleus has competent structure beyond that implied by the “dirty snowball” model. Genesis ends sample collection in April 2004 and returns samples to Earth in September.

Among the SSED developmental missions, workmanship issues were found with MESSENGER after the spacecraft was sent to the launch site. NASA decided on March 19 to postpone launch from May to the July–August window. The delay should provide sufficient time to resolve these issues and complete autonomy testing. Dawn passed its delta Confirmation Review in February but has two major gates to pass to continue: mass reconciliation and Critical Design Review. Spacecraft development for New Horizons is going well, but serious issues continue with respect to launch approval for a new vehicle (the Atlas V) with radioisotope thermoelectric generators (RTGs) on board. Because of delays in restarting plutonium-238 production at Los Alamos National Laboratory, the project is being replanned to accommodate lower end-of-mission power. The JIMO launch date under the President’s FY 2005 Budget appears to be delayed until 2015. A Discovery Program AO will be released April 17, 2004. In New Frontiers, up to three investigations will be selected for phase A in July 2004, from among the five proposals received for the high-priority mission concepts. There will be a down-select to one mission to enter phase B. Two proposals for missions of opportunity were also received.

**MEP and RLP Status Update.** Dr. Jim Garvin described the fundamental research being done for the MEP and the RLP. An AO for Mars Science Laboratory (MSL) investigations will be released April 14, 2004. The participating scientist program for the Mars Reconnaissance Orbiter (MRO) may be expanded. The Mars Telecommunications Orbiter (MTO), which will provide uplink capability for future landed missions, will also be a platform for Mars atmospheric observations. The final report of the Mars Exploration Program Analysis Group (MEPAG) Goals Committee is available on line at <<http://mepag.jpl.nasa.gov/reports/>>. Among the objectives of the Mars Test Bed missions will be studies of the radiation environment across the electromagnetic spectrum and studies of properties of martian soils and dusts. These missions will also test orbital search, rendezvous, and capture technology for recovering Mars samples from surface missions.

The goals of the RLP are (1) global reconnaissance to identify compelling sites (resources, science, etc.), (2) use of lunar missions as a technology proving ground, (3) realistic assessment of in-situ resource utilization possibilities, and (4) optimization of the human and robotic skill mix for exploration-enabled science goals. NASA has chartered an Objectives and Requirements Definition Team (ORDT) to provide a prioritized set of measurements for the LRO, within specified resource and schedule constraints, in support of stated exploration objectives. An AO for the instrument payload to respond to these priority measurement requirements will be released in May 2004. Dr. Garvin discussed the preliminary findings of the ORDT, including the three measurement themes and their associated measurement sets. NASA is developing a charter for a

Lunar Exploration Program Analysis Group (LEPAG), which will operate on the model of the MEPAG. The routine interface of both LEPAG and MEPAG with the Code S advisory committee structure will be through periodic reports to the Solar System Exploration Subcommittee (SSES).

**SECD Status Update.** Dr. Richard Fisher, SECD Director, described how the President's Exploration Initiative has affected SECD programs in terms of the impact of the FY 2005 budget request on each SECD budget line. In each year through FY 2009, the STP program was reduced substantially from earlier projections. The Solar Probe mission, which would be a flagship-class mission, has been under study by a Science and Technology Definition Team (STDT) as a mission to use nuclear power.

Dr. Fisher said that the SEC community will need to look for opportunities to adapt their program to fit more closely with objectives of the Exploration Initiative. His near-term plans include accelerating the planned senior review of SECD programs, a science program at the L1 Lagrangian point for studying the structure and evolution of the solar wind, and continuing with the 2004 Sounding Rocket Program. Planning will include the Solar Probe STDT and the future of the Sounding Rocket Program. SECD has 5 missions in development and 14 operational missions. Dr. Fisher used the International Living With a Star (ILWS) Program to illustrate the political and economic benefits, as well as scientific and technological advances, of SECD collaborative efforts. International collaborations can be positive when there is an appropriate division of labor, backed up by agency-to-agency agreements for specific missions. SScAC members and Dr. Fisher discussed ways that SEC activities could be adapted for relevance to other planets, as well as to the Earth. Planetary magnetosphere and planetary aeronomy missions in the Discovery Program are among the possibilities. Project Prometheus and nuclear electric propulsion (NEP) have removed major obstacles to an Interstellar Probe mission. Dr. Jonathan Lunine noted the historical partnership between planetary science and space physics for missions to the outer solar system.

#### Subcommittee Reports and Recommendations

Dr. Edward Kolb, chair of the Structure and Evolution of the Universe Subcommittee (SEUS), presented the report from its February 2004 meeting. After summarizing the presentations and major discussion topics of the meeting, Dr. Kolb described the impacts of the Exploration Initiative on the Beyond Einstein Program. The SEUS sees problems developing in the budget outyears if the Beyond Einstein program is unable to ramp up at the previously planned rate, even after the one or two year delay. One danger is that the partnership with the European Space Agency (ESA) on LISA could be imperiled. A second is that mission technology may have to be selected before it has been adequately developed (premature down-select). The SEUS is also concerned that the new funding profile for the Constellation X mission does not appear suitable for a flight program. It may not be possible to hold teams together unless the mission is made into an international collaboration. The indefinite postponement of the Einstein Probes may imperil the NASA partnership with the Department of Energy on a Joint Dark Energy Mission (JDEM). He then reviewed the SEUS actionable items for consideration by the SScAC (Appendix G).

Dr. David Spergel, chair of the ASO Subcommittee, presented the report from its February 2004 meeting. The ASO Subcommittee discussed the impact of the cancellation of SM-4 and agreed that, if a servicing mission could be done in any way, it would benefit ASO science. Dr. Spergel reviewed the Subcommittee's letter to the SScAC and actionable items (Appendix E). A concern expressed by the ASO Subcommittee with the reorganization in light of the Exploration Initiative was whether investments that the Office of Aerospace Technology (Code R) had been making in

key technologies for ASO science, such as lightweight optics and detectors, would be continued with the transfer of those activities to Code T. Dr. Michelle Thomsen and Dr. Kolb noted that their subcommittees had expressed parallel concerns about the transfer of space science instrument technology development to Code T.

Dr. Jonathan Lunine, chair of the Solar System Exploration Subcommittee (SSES), presented the recommendations and supporting statements from the February 2004 meeting of the SSES (Appendix H). The SSES was concerned that Exploration Initiative priorities might distort ongoing SSED programs such as Discovery or New Frontiers. Other concerns were the freeze in R&A funding across SSED and maintaining a strong interface between JIMO science preparations in Code S and Prometheus/JIMO propulsion technology development in Code T. Dr. Lunine described the initiation of work by SSES members on the next SSES road map.

Dr. Michelle Thomsen, chair of the Sun-Earth Connection Advisory Subcommittee (SECAS), presented the report from the SECAS March 2004 meeting (Appendix F). She discussed her subcommittee's views on the changes to the SECAS budget between SECD projections and the President's FY 2005 budget request. The shortfall in mission operations and data analysis (MO&DA) funding will mean terminating some operating missions that are highly productive. The SECAS considers STP to be the foundational science line for SEC and is concerned that the rate of investment is not forecasted to recover, even after the STP delay, to the levels originally planned. The STP missions were planned to have overlaps so that interactions between solar events and impacts on Earth could be studied. Stretching out the program will make these concurrent observations impossible. In this context, Dr. Thomsen presented the recommendations offered by SECAS for SScAC consideration. During the discussion, SScAC members discussed the Solar Probe mission and the synergy between the STP program as discovery and the LWS program as exploiting that new knowledge. This relationship should be viewed as a paradigm for exploration of other planets.

#### NAC Assignment on Enterprise Contributions to Exploration

Dr. Christensen explained the NAC's assignment to the SScAC to comment on support from the Space Science Enterprise to the Exploration Initiative, as well as impacts of the Initiative on the Enterprise themes. He asked the chairs of the subcommittees to present their initial thoughts on these NAC questions, in the context of the theme or division each subcommittee covers.

Dr. Kolb said that, if a narrow view is taken of exploration as going to the Moon and then to Mars and other nearby locations, the SEU theme does not fit very well. If a larger view is taken of exploring the universe, then SEU has a role in providing detectors and other instrumentation for exploration missions. On impacts to the SEU theme, the portfolio of space science missions has been changed by a process different from that which Code S has usually used for deciding on priorities and programs. The resulting changes to the Beyond Einstein program will mean postponing the search for answers to significant scientific questions, so a major impact is the science that will not be done. Dr. Rod Heelis added that the science that will not be done does have relevance to the Exploration Initiative. The SScAC discussed the extent to which it could interpret the President's vision.

Dr. Lunine said that the SSE theme is directly relevant to the Exploration Initiative because both the Moon and Mars are within the theme's scope. Technologies relevant to the initiative's human exploration objectives need to be developed and proven, and this can be done more safely and at lower cost with robotic missions first. The Exploration Initiative affects SSE in that the Moon has greater emphasis in the Initiative than it did in the SSE Decadal Survey. The Exploration Initiative has created continuity for the MEP beyond 2009, heightened the impetus for MSR, and



provided additional Principal Investigator–led mission opportunities (Scout Program). Dr. Heidi Hammel noted that there is core science on the solar system that is not contained within the SSE theme, and efforts in those areas need to be maintained.

Dr. Thomsen said that SECD programs could support the Exploration Initiative through enhancing national prestige and increasing our understanding of the reasonable and feasible objectives for human exploration. The Exploration Initiative emphasizes questions of life and habitability, but there is danger in interpreting exploration as just the search for life and habitability. Within the scope of the SEC theme are topics directly relevant to human exploration, such as radiation effects from the Sun, understanding terrestrial and planetary radiation belts, solar effects on planetary atmospheres, and effects of solar flares. If exploration is interpreted more broadly, SEC programs contribute to understanding the flow of energy and matter through the solar system. SEC programs also help to inspire and train the next generation work force, which will be required for the Exploration Initiative. SEC missions are also relevant as candidates for demonstrating new power and propulsion technologies. The impacts of the Exploration Initiative on SEC programs probably include premature termination of current operating missions and stretching out future missions so that plans for concurrent, distributed observations in different locations of the nearby solar system will not be possible. A broader interpretation of exploration is needed, beyond addressing the issues of life and habitability elsewhere in the solar system and the universe.

Dr. Spergel said that the ASO theme was deemed compliant with the Exploration Initiative because the theme addresses the search for life and habitability. The TPF mission is central to the President’s vision. However, a concern of the Origins Subcommittee (OS) is that the President’s vision will be interpreted too restrictively as a search for life, even within the ASO theme. He agreed with the other subcommittee chairs that NASA, as well as the ASO theme, would benefit from a broad reading on Initiative goals. Other OS members expressed concern that a narrow interpretation of “exploration” could exclude the JWST. The SScAC continued discussing whether a broad interpretation of exploration, as favored by the members, was an intended or acceptable view, and whether NASA’s role as a major force for science and scientific discovery in the United States should be emphasized. The members discussed how to express the need for balancing space science with human exploration as elements of NASA’s mission. Dr. Christensen made writing assignments for the subcommittee chairs and set up working groups of the other members to draft material on the principal topics that had arisen during the discussion.

#### Transfer of the Mission and Science Measurement Theme from Code R to Code T

At Dr. Christensen’s request, Mr. Giulio Varsi described the transfer of the entire Mission and Science Measurement (MSM) theme in Code R to become the Advanced Space Technologies program in Code T. MSM technology development was not mission-specific. Under full-cost accounting, the budget line was \$430 million per year. Mr. Varsi described the individual programs within MSM and their budgets. Although the new Advanced Space Technologies budget is \$100 million less, in effect \$50 million of that will be absorbed in the new Code T program called Maturation Technologies. Another piece is absorbed in the new Technical Achievements program in Code T. The net reduction is about \$60 million.

Code T is analyzing the alignment of the transferred programs with its own mission and objectives. Prioritization will be framed in terms of (1) technologies in direct support of human exploration, (2) technologies in direct support of robotic exploration, (3) technologies in support of exploration conducted by other Enterprises, (4) technologies in support of programs in other Enterprises not aligned with exploration objectives, and (5) technologies that are no longer relevant. The Code T view is that about one-third of the projects need serious realignment and

some need to be canceled entirely. Code S is now going through the content of the Code T technology programs task by task to determine what aligns with Code S programs. There will be a series of meetings with Code T. A proposal has been made to establish joint requirements teams to consider the needs of both Code T and Code S in exploration-relevant areas. Examples include in-space propulsion and the New Millennium Program. Whatever coordination can be achieved will need to be done by June, when budgets are distributed to the Enterprises for this year's Program Operating Plan.

***Friday, March 26, 2004***

Sounding Rockets: Funding Allocation and Status of Science Appraisal

Dr. Richard Fisher, SECD Director, provided an update for the SScAC to his November 2003 report on the Suborbital Rocket Program. The program is administered by the SEC Division for all of OSS, not just the SECD. The technology development for advanced rocket motors (high altitude sounding rocket), which Dr. Fisher had discussed in November, is unlikely to occur, given the President's FY 2005 budget submission. The major cost drivers for the program are the launch sites, vehicle types, payload complexity, and flight rate. Dr. Fisher reviewed the parameters underlying each of these cost drivers. If the flight rate drops below 20 per year, the current support workforce for the program cannot be sustained.

The prioritization process for the Suborbital Rocket Program will identify the strategically important science that requires sounding rocket implementation and determine what resources in the program office are required to support that science. Three areas of science are involved: (1) science questions specific to the altitude at which sounding rockets fly, (2) cost-effective technology development prior to flight on larger, more expensive missions, and (3) training opportunities provided by a less expensive launch alternative. In the intermediate term, the use of the Geospace Mission Operations Working Group to assess program priorities will need to be broadened to a working group representing all the OSS themes. In the near term, the flights on the FY 2004 manifest will be prioritized. These priorities will determine program office spending. In July, Dr. Fisher will report on the results of this prioritization process to the SScAC and its subcommittees.

In the question period, Dr. Kolb agreed on the importance of identifying strategically important science that could be aligned with the Suborbital Rocket Program's capabilities. He and other members suggested that the Long Duration Balloon Program should be included with the assessment of the Suborbital Rocket Program. Other issues discussed were the minimum flight rate to sustain a viable flight support infrastructure, the impact of payload and experiment complexity on flight cost, and ground rules to ensure the scientific quality of the missions flown. In reply to a question from Dr. Christensen, Dr. Fisher said the flight rate would drop to 10-12 flights per year in the next 18 to 20 months, given the FY 2005 budget. The OS and SEUS chairs reported that their subcommittees saw the technology development and education values from the program as exceeding the value of science questions that could only be addressed with suborbital rockets.

2006 Strategic Planning Process and Schedule

Dr. Allen reviewed the OSS and NASA rationale for strategic planning by the Enterprises. He outlined the process in terms of those aspects within the control of OSS and its associated science communities, as well as those aspects outside OSS control (controlled at Agency and higher levels). There are now more influences and constraints on the OSS planning process than in the past. The process for updating, revising, and reviewing the theme road maps will be similar to that used in the previous round, with the final versions of the roadmaps to be delivered by March

2006. The resulting OSS Strategy document will go into production in April 2006, with release in May 2006. The subcommittees will work on drafting and revising roadmaps for their themes during the year ending in March 2005. A community consensus workshop is projected for August 2005. Dr. Allen intends to use the process to ensure that the NASA Strategic Plan is consistent with the current science objectives developed through the interactions with the science community. Fifteen year-long “vision mission” studies have been initiated to contribute to this round of road mapping.

The Exploration Initiative removes the traditional separation in the NASA organization between space science programs and human spaceflight. However, it also creates a new distinction between science programs viewed as within the Initiative and “Other” science programs. In this environment, Dr. Allen stressed the importance of maintaining the science objectives as the focus of the OSS planning and roadmapping process. He discussed with the SScAC members several options for relating the science objectives to the Research Focus Areas (RFAs). The SScAC consensus was that networked mapping between the objectives and the RFAs was likely to be the better approach, rather than a strict hierarchy of RFAs falling under a single objective. The network relationships could be supported with a crosswalk table. At some point, Dr. Allen said, the OSS programs will need to be mapped against the Exploration Initiative. Other aspects to consider during the planning process include inter-Enterprise connections and implications for international cooperation.

The procedure this year for assessing progress on science goals under the Government Performance and Results Act (GPRA) will be similar to that used last year, except that the NASA draft narratives for accomplishments will not include draft “color code” grading. The initial grading will be done by the subcommittees, then reviewed, revised, and approved by the SScAC.

#### Work Team and Draft Discussion Session

Dr. Christensen reviewed the topics to be covered in the SScAC letter to Dr. Weiler. He then led the discussion by all SScAC members of the scope of each topic, the principal points to be made, and potential reorganizations of topics. Drafting assignments for the topics were made, and the plenary session was suspended while work groups of members drafted material on their assigned topics. The subcommittee chairs worked together on the response to the NAC questions on the Exploration Initiative. The plenary session reconvened at 11:30 a.m.

#### Office of Exploration Systems

Rear Admiral Craig Steidle (U.S. Navy, retired), newly appointed Director of the Office of Exploration Systems (Code T), provided a program overview for the SScAC. With respect to the President’s Vision for Space Exploration, Adm. Steidle emphasized that it sets clear budgetary boundaries by stating firm priorities and tough choices, as well as establishing ambitious goals and objectives. The exploration program must be sustainable, so all the pieces must be integrated and affordable. The charge to Code T is to “develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration.” Adm. Steidle sees 12 of the 18 elements in the Vision for Space Exploration as falling within the scope of Code T. For example, on the elements for lunar missions, Code T owns the requirements and is the customer for Code S mission execution. Other elements in the Vision include conducting robotic exploration of Mars to prepare for future expeditions; conducting robotic exploration across the solar system to search for life, understanding the history of the universe, and search for resources; and conducting advanced telescope searches for habitable environments around other stars. The Moon will serve as a test bed to reduce the risk for future human missions to Mars. The statement of work in the already-released Request for Proposal (RFP) for JIMO will be changed to fit with the new exploration objectives.

As background for the way he intends to manage Code T, Adm Steidle reviewed the experience of the Department of Defense (DoD) since 1993 in canceling programs that were not affordable and replacing them with new programs. He intends to use the findings of the Packard Commission and the Young report to incorporate lessons learned into space systems development programs. For example, operators and technologists should be brought together to enable cost-performance trade studies. In this strategy-to-task-to-technology process, the Nation's Vision for Space Exploration generates the tasks. Those tasks are analyzed to determine requirements and technology gaps. Trade studies generate the system requirement documents and the investment plan. System requirements once generated are not allowed to change or to be waived. The pieces contributed from other Enterprises than Code T will have to be integrated vertically into the overall Agency program. Within the Requirements Division of Code T, astronauts, technologists, and systems analysts will staff the systems integration function. Technologists will manage the technology development programs that emerge from the process for identifying requirements and gaps.

Evolutionary acquisition of space systems must incorporate the concepts of spiral development and incremental development. In the Constellation Program, NASA will be undertaking a spiral development process, with the Crew Exploration Vehicle (CEV) as the first spiral. The next spiral will be defined by the pieces that come out of the first spiral. The acquisition strategy for Constellation begins with canceling the Next Generation Launch Technology (NGLT) and Orbital Space Plane (OSP) programs, as their requirements are not applicable to Code T tasks. The 140 technology programs that were transferred to Code T from Code R have been realigned for technology maturation. Of these, 30 percent fit well with Code T tasks, 25 percent need to be refocused, and the others do not fit. The latter requirements return to Code S or Code R. The acquisition strategy follows defined milestones leading to a head-to-head demonstration and down-select of CEV capability in FY 2008. Project Prometheus is being refocused to be more than a demonstration of technology for the JIMO mission. It will be used to demonstrate power and propulsion capability for the Constellation Program. A spiral development approach, rather than linear technology development, will be used for Project Prometheus technology.

To stimulate innovation and competition, NASA will establish prize purses in a program of contests called the Centennial Challenges. Areas for these challenges may include revolutionary advances in fundamental technologies, breakthrough robotic capabilities, and very low cost space missions. The final selection of challenges will be subject to external inputs with internal review and decision.

Adm. Steidle listed the FY 2004 products to come from the Requirements Division, Development Division, and Business Operations Division of Code T. For program assessment, the Business Operations Division will create an Earned Value Management System that integrates program and financial management.

In response to a question on how the SScAC could help, Adm. Steidle said that he is using the NAC as his oversight committee for the time being. He communicates regularly with OSS leadership, including Dr. Weiler and Dr. Garvin. In the future, he expects to have an advisory group on exploration that combines scientists and technologists. Some Agency-wide programs that have been moved into Code T, such as high speed computing and computational fluid dynamics, need to be sustained because of their value to the Agency as a whole, even if they are not essential to near-term exploration objectives. In response to a question on the interface of JIMO and NEP technology programs with JIMO/Project Prometheus science objectives, Adm. Steidle agreed that continuing attention to the interface is essential. He said that the Agency and

the Exploration Initiative need to be able to integrate all the pieces vertically and avoid isolation of programs that should be closely tied (“stovepipes”). To a question about sustaining the instrument technologies essential to scientific progress in areas such as astronomy, which had previously been in Code R, he said that the Code T technology assessments are being performed in conjunction with the Enterprises from which the programs were transferred. Mr. Chris Scolese of Code S agreed that communication with Code T on the science-related technology programs has gone well. Dr. Hammel suggested that scientists implementing Code S missions relying on technology development now in Code T should be represented in the group of operators within Code T’s Requirements Division. On the role of the robotic exploration program in relation to human exploration, Adm. Steidle said that approved robotic missions in Code S will stay as they are, even if they are now considered part of exploration. Code T robotic missions will be precursors to human exploration missions.

Mr. Scolese thanked the SScAC for its recommendations. He emphasized the similarity in vision for the Exploration Initiative between Adm. Steidle and Dr. Weiler. Dr. Christensen thanked the members for their efforts and adjourned the meeting.

## AGENDA

### SPACE SCIENCE ADVISORY COMMITTEE

March 25–26, 2004  
Grand Hyatt at the Washington Center  
1000 H Street, N.W.  
Washington, D.C.

#### *Thursday, March 25*

8:30	Welcome and Announcements	M. Allen A. Christensen
8:45	Program Overview Status Briefing with Q&A	E. Weiler
10:00	BREAK	
10:15	Division Reports and Q&A – Part 1	A. Kinney O. Figueroa
Noon	LUNCH	
	Science Talk: Early Results of SIRTf/Spitzer	M. Werner
1:00	Division Reports and Q&A – Part 2	R. Fisher
1:30	Committee Discussion	A. Christensen
2:00	Subcommittee Reports and Recommendations – Part 1	E. Kolb D. Spergel
3:00	BREAK	
3:15	Subcommittee Reports and Recommendations – Part 2	J. Lunine M. Thomsen
4:15	NAC Assignment: Enterprise Contributions to Exploration	A. Christensen
5:00	Committee Discussion and Writing Assignments	A. Christensen
6:30	Committee Dinner	

#### *Friday, March 26*

8:30	2006 Strategic Planning Process and Schedule	M. Allen
9:15	Sounding Rockets: Funding Allocation and Status of Science Appraisal	R. Fisher
10:00	BREAK	
10:15	Committee Discussion	A. Christensen
Noon	LUNCH	
	Science Talk: Breaking News from the MER Rovers	S. Saunders
1:00	Preparation of Recommendation Letter	A. Christensen
2:00	Report to AA and Discussion	A. Christensen E. Weiler
3:00	Status and Plans of Office of Exploration Systems, Q&A	C. Steidle
4:00	Preparation of Recommendation Letter Concluded	A. Christensen
5:00	Adjourn	

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)  
MEMBERSHIP LIST  
March 25, 2004

Dr. Andrew B. Christensen, Chair  
Northrop Grumman Space Technology

Dr. David N. Spergel  
Princeton University

Dr. David W. Deamer  
University of California, Santa Cruz

Dr. Michelle F. Thomsen  
Los Alamos National Laboratory

Dr. Jonathan E. Grindlay  
Harvard-Smithsonian Center for  
Astrophysics

Dr. Marc S. Allen (Executive Secretary)  
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Tel: 202-358-2470  
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Dr. Heidi B. Hammel  
Space Science Institute

Dr. Fiona A. Harrison  
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Dr. Roderick A. Heelis  
University of Texas at Dallas

Dr. Garth D. Illingworth  
University of California, Santa Cruz

Dr. Judith T. Karpen  
Naval Research Laboratory

**Pending Member**  
Dr. Michael W. Werner  
Jet Propulsion Laboratory

Dr. Andrew C. Klein  
Oregon State University

Dr. Paul H. Knappenberger  
Adler Planetarium and Astronomy Museum

Dr. Edward W. Kolb  
Fermi National Accelerator Laboratory

Mr. Martin P. Kress  
Battelle Memorial Institute

Dr. Jonathan I. Lunine  
The University of Arizona

Dr. Jeremy R. Mould  
National Optical Astronomy Observatory

Dr. John F. Mustard  
Brown University

**SPACE SCIENCE ADVISORY COMMITTEE**

March 25–26, 2004

Grand Hyatt at the Washington Center

1000 H Street, N.W.

Washington, D.C.

## MEETING ATTENDEES

*Committee Members:*

Christensen, Andrew, *Chair*  
Allen, Marc, *Executive Secretary*  
Grindlay, Jonathan  
Hammel, Heidi  
Harrison, Fiona  
Heelis, Roderick  
Illingworth, Garth  
Karpen, Judith  
Klein, Andrew  
Knappenberger, Paul  
Kolb, Edward “Rocky”  
Lunine, Jonathan  
Mould, Jeremy  
Mustard, John  
Spergel, David  
Thomsen, Michelle  
Werner, Michael

Northrop Grumman Space Technology  
NASA Headquarters  
Harvard-Smithsonian Center for Astrophysics  
Space Science Institute  
California Institute of Technology  
University of Texas at Dallas  
University of California, Santa Cruz  
Naval Research Laboratory  
Oregon State University  
Adler Planetarium and Science Museum  
Fermi National Accelerator Laboratory  
University of Arizona  
National Optical Astronomy Observatory  
Brown University  
Princeton University  
Los Alamos National Laboratory  
Jet Propulsion Laboratory

*NASA Attendees:*

Bergstralh, Jay  
Blanding, Katie  
Burch, Preston  
Crain, Philippe  
Dakon, Kathy  
Dantzler, Andrew  
Fisher, Richard  
Frederick, Suzanne  
Garvin, Jim  
Geithner, Paul  
Greene, Thomas  
Hasan, Hashima  
Hertz, Paul  
Kaluzienski, Louis  
King, Marla  
Kinney, Anne  
Kniffen, Don  
Leck, Renee  
Manuel, Greg  
Mellott, Mary  
Montemerlo, Mel

NASA Headquarters  
NASA Headquarters  
NASA/GSFC  
NASA Headquarters  
NASA Headquarters  
NASA Headquarters  
NASA Headquarters  
NASA/JPL  
NASA Headquarters  
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NASA Headquarters  
NASA Headquarters  
NASA Headquarters  
NASA Headquarters  
NASA/GSFC  
NASA Headquarters  
NASA Headquarters



*NASA Attendees, continued*

Moore, Michael	NASA Headquarters
Nelson, Robert M.	NASA/JPL
Norris, Marian	NASA Headquarters
Petron, Bill	NASA
Pfaff, Robert	NASA/GSFC
Plentovich, Beth	NASA
Riegler, Guenter	NASA/ARC
Salamon, Michael	NASA Headquarters
Saunders, Steve	NASA Headquarters
Scolese, Chris	NASA Headquarters
Six, Frank	NASA/MSFC
Smith, Eric	NASA Headquarters
Varsi, Giulio	NASA/Headquarters
Vondrak, Richard	NASA/GSFC
Wainio, Lisa	NASA Headquarters
Weiler, Ed	NASA Headquarters
Westmeyer, Paul	NASA Headquarters
Wilkinson, Chris	NASA Headquarters
Wiseman, Jennifer	NASA Headquarters
Woods, Dan	NASA Headquarters

*Other Attendees:*

Anderson, Bob	Boeing
Beres, Kathleen	Orbital
Bocek, Bob	Boeing
Bordi, Francesco	Aerospace
Brandt, David	Lockheed Martin
Bruno, Mary	Ball Aerospace
Conte, Dom	Spectrum Astro
Di Biasi, Lamont	L. Di Biasi Assoc., Southwest Research Institute
Herman, Daniel	Brashear LP
Hanson, Ron	California Institute of Technology
Hopkins, Joanne	SRI International
Kaplan, Mike	Boeing
Katt, Robert	INFONETIC
Lester, Dan	University of Texas
Margon, Bruce	Space Telescope Science Institute
Mathae, Kathy Bailey	AAU
Purdy, William	Ball Aerospace
Richardson, Larry	Boeing - Delta
Rodriguez, Michelle	SRI International
Webster, Malcolm	NTTC
Zanetti, Lawrence	John Hopkins University/Applied Physics Laboratory

## SPACE SCIENCE ADVISORY COMMITTEE

March 25–26, 2004

Washington, D.C.

LIST OF PRESENTATION MATERIAL<sup>1</sup>

- 1) Edward J. Weiler, Office of Space Science, *Space Science and the President's Renewed Spirit of Discovery*. Presented to the Space Science Advisory Committee. March 2004.
- 2) NASA, *The Vision for Space Exploration*. February 2004.
- 3) Anne Kinney, Director, Astronomy and Physics Division, NASA Office of Space Science, *Astronomy and Physics Division Overview Presented to Space Science Advisory Committee*. March 25, 2004.
- 4) Orlando Figueroa, Director, Solar System Exploration Division, *Solar System Exploration*. March 25, 2004.
- 5) Richard Fisher, Director, Sun-Earth Connection Division, *Report To SScAC*. March 25, 2004.
- 6) Jim Garvin, NASA Lead Scientist for Moon and Mars, *State of Mars (and Moon) Science*.
- 7) David Spergel, Chair, Astronomical Search for Origins Subcommittee, Letter to Andrew Christensen, Chair, Space Science Advisory Committee, Subject: Astronomical Search for Origins Subcommittee Meeting.
- 8) Edward Kolb, Chair, Structure and Evolution of the Universe Subcommittee, Letter to Andrew Christensen, Chair, Space Science Advisory Committee, Subject: Structure and Evolution of the Universe Subcommittee Meeting.
- 9) Michelle Thomsen, Chair, Sun–Earth Connection Advisory Subcommittee, Chair, Space Science Advisory Committee, Subject: Sun-Earth Connection Advisory Subcommittee Meeting.
- 10) Jonathan Lunine, Chair, Solar System Exploration Subcommittee, Letter to Andrew Christensen, Chair, Space Science Advisory Committee, Subject: Solar System Exploration Subcommittee Meeting.
- 11) Office of the Administrator, *Cancellation of the Fifth (SM-4) Hubble Servicing Mission*.
- 12) Mary Mellott and Richard Fisher, *Sounding Rocket Operations: FY 2005 President's Budget*. Report to SECAS, March 10, 2004, and SScAC, March 25, 2004.
- 13) Marc S. Allen, NASA Office of Space Science, *Strategic Management Topics*. Presentation to the Space Science Advisory Committee, 26 March 2004.
- 14) Rear Admiral Craig E. Steidle (Ret.), Office of Exploration Systems, *Office of Exploration Systems: Program Overview*. March 24, 2004.
- 15) Letter from Edward Weiler to Bruce Alberts, National Research Council, requesting a review of options to extend the life of the Hubble Space Telescope.
- 16) Michael Werner, Spitzer Space Telescope Project Scientist, *The Spitzer Space Telescope: New Views of the Cosmos*. March 25, 2004.
- 17) Science Definition Team Report, *LWS Targeted Research and Technology*. November 2003.
- 18) NASA LWS Sun-Climate Task Group, *Living with a Star: New Opportunities in Sun-Climate Research*. December 2003.

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<sup>1</sup> Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, DC 20546.

**Letter from the Chair, Astronomical Search for Origins Subcommittee,  
to the Chair, Space Science Advisory Committee**

March 23, 2004

Dr. Andrew Christensen, Chair  
Space Science Advisory Committee  
NASA Office of Space Science

Dear Dr. Christensen:

The Origins Subcommittee met at the University of Maryland on February 24 and 25. In a separate letter, I have already sent on two topics for discussion at the SScAC; the SM4 cancellation and a discussion of technology development. This letter describes the presentations at our meeting and contains recommendations that are specific to the Astronomical Search for Origins program.

As part of this meeting a joint session of OS & SEUS was addressed by Astronomy & Physics Director Anne Kinney and by Associate Administrator Ed Weiler. The President's FY05 proposed budget, described by Kinney and Weiler, shows strong support for Origins Science. However, there were several delays and reductions in the budget that will have a significant impact on astrophysics: a cut in the Explorer program, delays in Constellation X, LISA and no funds to start the Beyond Einstein Initiative.

Philippe Crane reported on the status of the Astronomical Search for Origins program. SOFIA continues to make good technical progress; however, the first science flight has now been delayed until April 2005. SIM continues to meet technical milestones and appears to be on-track for meeting its science goals. Other missions are discussed below and aspects of his report are discussed below.

### **Origins Probes**

The ROSS-04 supplement was released on Feb. 18, 2004. NASA plans to fund roughly 10 studies of future missions in the \$650 – 700 M range for launch after 2010. These reports will provide an important input to the next Origins Roadmap. *The road mapping team will likely invite the selected study teams to make presentation of their mission study results in early 2005.*

### **JWST**

John Mather reported on on-going progress in the JWST program. With Goddard Space Flight Center taking on the responsibilities for the Lunar Initiative, the committee is concerned that top engineering talent will be redirected from JWST towards the Lunar Initiative.

### **NASA Astrobiology Institute**

Bruce Runnegar, the new director of the NAI, outlined the NAI program in astrobiology. *The Origins Committee was pleased to learn of continuing efforts to strengthen the involvement of the astronomy community in this program and of the selection of several new centers with strong astronomical involvement.*

## TPF

President Bush has recognized the Terrestrial Planet Finder as an important part of NASA's long-term vision. This challenging mission is one of the primary goals of the Origins Roadmap.

The TPF project has redefined its science goals. Rather than require that the mission study the nearest Earth-like planets, the mission goal is to study the nearest ( $< 10\text{--}15$  parsec) planetary systems. This is a better-defined science goal, as it does not require a precise knowledge of the frequency of Earth-sized planets. The CAA has been asked to review this new emphasis for the TPF project

## HST Operations

Preston Burch reported on the HST projects efforts to maintain HST operations as long as possible without SM4. There are two significant threats to HST's continued operations: battery failure and loss of gyros. HST is making progress in its plans to develop a 2-gyro mode.

Steve Beckwith reported on plans to maximize the science return from Hubble during its final years of operation. STScI is organizing a major conference and is making significant efforts to involve the community in efforts to define HST's science program. *The Origins Committee endorses these plans.*

## Sounding Rocket Program

Philip Eberspecker described the status of the sounding rocket program. While the sounding rocket program plays an important role both in developing technology and in training the next generation of instrumentalists, it is challenging to identify important science questions that can be addressed with short duration rocket flights. *The Origins Subcommittee has asked the APWG for a more detailed report on the Sounding Rocket program and on its science selection.*

## Spitzer

Tom Soifer reported on the on-going success of the Spitzer telescope. The Origins Committee was excited to learn some of the new results from Spitzer and congratulates the Spitzer science team and members of the Spitzer Science Center on its successes.

Sincerely,

David Spergel, Chair, for the Origins Subcommittee



*International, Space, and Response Technologies Division*

Space and Atmospheric Sciences (ISR-1)

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(505) 667-1210/Fax (505) 665-7395

March 19, 2004

ISR-1-04-027

Dr. Andrew Christensen

Northrop Grumman Space Technology

One Space Park, R9-1914

Redondo Beach, CA 90278

Dear Andy,

The Sun-Earth Connections Advisory Subcommittee met in Washington on March 10-12. We had a very full agenda, a copy of which is attached to this letter. We appreciate the informative presentations we heard, and we are particularly grateful to Ed Weiler and other Headquarters personnel for taking the time to be with us.

As you are well aware, the OSS portion of the recently released President's FY05 budget request contained some big changes from the budget that emerged from the extensive strategic planning process NASA has pursued for a number of years. The impact of these changes is particularly severe for the SEC and SEU themes, and much of our discussion was aimed at trying to understand the consequences for the SEC program and what actions might be taken to alleviate some of the problems.

To illustrate the level of impact on SEC programs, here are the ratios of funding proposed for certain program areas in the President's FY05 budget request, relative to what was submitted by NASA to OMB in the fall of 2003 for the same categories:

Program Area	FY05	FY06	FY07	FY08	FY09
MO&DA	1.0	0.95	0.83	0.78	0.74
Rocket Ops	0.95	0.83	0.77	0.74	0.74
Explorers	0.42	0.68	0.50	0.86	0.99
Solar-Terrestrial Probes	0.22	0.18	0.25	0.54	0.51

SECAS is greatly concerned that this budget, if realized, would damage a healthy, productive, and popularly-valued part of its exploration mandate, namely the SEC science program. Thus, you will see that several of the SECAS findings detailed and summarized in the attachments are intended to call attention to the impact of the proposed budget and to request assistance in ameliorating some of the most severe consequences. Our other findings propose actions that can be taken in light of the proposed budget to rescue important near-term science opportunities.

SECAS welcomes the upcoming roadmap process as an opportunity to clarify the vital role of SEC science in fulfilling the nation's vision for the exploration of the solar system and beyond.

Our specific findings and a brief summary thereof are attached.

Best regards,

Michelle F. Thomsen  
SECAS chair

cc Dr. Richard Fisher

attachments

SECAS Findings from 10-12 March 2004 Meeting  
Summary of SECAS Findings  
Agenda for 10-12 March 2004 SECAS Meeting

## SECAS Findings from 10-12 March 2004 Meeting

1) *SEC and the Presidential Vision for Exploration*

SECAS is pleased that the value and importance of space exploration have been acknowledged at the highest levels of our government. We believe that the nation is well served by a vigorous program to explore and understand our space home and the wider universe beyond. However, we are greatly concerned that an overly narrow interpretation of "exploration" will seriously affect the current vibrant and productive exploration programs in SEC and SEU. A vital program of scientific exploration is needed both to support human exploration and to advance our knowledge of space and the fundamental processes that operate throughout the solar system and beyond. The business of the SEC theme is exactly such exploration. Planned SEC missions and programs systematically probe regions of space and physical processes throughout the solar, heliospheric, planetary and Geospace environments. SEC explores the inter-relationships that exist within the coupled solar-planetary system, and SECAS believes that this science is essential to realizing the newly enunciated vision of exploration.

Based on the President's proposed FY05 budget allocations, SECAS is concerned about the future of the SEC science enterprise. The proposed budget includes large reductions in the planned funding for the Solar Terrestrial Probes line, the Explorer line, the Sounding Rocket and Research and Analysis programs, and Mission Operations, even though these programs have been repeatedly studied, endorsed by the National Academy of Sciences and strongly supported by the space science community. If this budget is realized, it will lead to shortfalls in scientific progress, lack of synergy between the program elements, missed opportunities, and deterioration of the research base. Beyond this, there are wider impacts, including a weakening of US leadership in space sciences. Lost will be carefully planned, valuable contributions to society, technology, national security, and to the goals of exploration.

Nowhere are these potential impacts more evident than in the de-emphasis of the Solar Terrestrial Probes line. As an illustration, consider the status of our understanding of the role of magnetic fields and magnetic energy release throughout the solar system. Energy is stored in magnetic fields by the solar dynamo and subsequently released and converted into heat, flows and radiation. High-energy particles and massive ejections of solar material can accompany magnetic energy conversion on the sun, leading to great changes in interplanetary conditions, to magnetospheric storms, and to dangers to technological assets and human activity in space, as well as other possible effects not yet discovered. Understanding how these fundamental and ubiquitous processes work is a crucial and intellectually challenging underpinning to exploration of the solar system and beyond. However, the only possibilities in the foreseeable future to directly investigate magnetic energy release and its consequences are found in the near-Earth environment. Through a carefully planned and overlapping sequence of STP missions, SEC will first directly explore the physics of the flow of energy in the terrestrial magnetosphere (the MMS mission), then will examine the global consequences for the magnetospheric system (the MagCon mission), and finally will elucidate the implications for the Geospace environment (GEC mission). Under the President's proposed budget, these missions are delayed such that only the first one even appears on the horizon. We believe that this slow-down does major damage to NASA's space science program by curtailing the access to space for missions aimed at exploring the fundamental nature of the universe in which we live. It also indirectly affects our ability to address some of the crucial societal impacts of space weather since STP science (such as magnetic reconnection) forms part of the underpinnings of Living With a Star research. We conclude that the essential STP line should be restored to its carefully planned and integrated schedule as soon as possible.

A robust program of fundamental space science objectives is necessary to achieve the goals of the new exploration vision. SECAS believes that our ability to support this vision

requires a breadth in SEC missions, including both a discipline balance and a balance between small, medium and large missions. We also believe that the process of revising program priorities would greatly benefit from input from the science community. NASA has a responsibility to carry out appropriately motivated basic research. We therefore urge NASA and SEC to firmly maintain NASA's longstanding commitment to understand the space environment, supporting a robust SEC program including the foundational STP line.

## 2) *Operating Missions: A Distributed SEC Observatory*

SECAS notes that the fourteen currently operating satellites of the Sun-Earth Connection Division span the solar system from the Sun and near-Sun interplanetary medium to the edge of the Heliosphere, and near Earth from the top of the atmosphere to the top of Geospace. This fleet of spacecraft is unprecedented in the quality and breadth of data being gathered, returned, and analyzed, enabling for the first time the pursuit of a complete picture of the sun and its relationship to the planetary system. For example, these satellites, and those at Mars, chronicled the violent October-November 2003 solar eruptions as they wreaked havoc throughout the solar system. Without these complementary satellite assets, our exploration of the coupled Sun-planetary system would be greatly compromised, as would be our ability to support future human and robotic exploration of the Moon, Mars and beyond.

SECAS views with concern the prospect that budgetary impacts to the MO&DA, Supporting Research and Technology, and Guest Investigator programs will result in the loss of significant key elements of this unique flotilla of space explorers at a time of increasing need to understand the effects of solar variability throughout the solar system. The scientific value of the fleet cannot be overemphasized. The costs to operate it at full capacity pale in comparison to replacement costs. Once lost, these capabilities cannot be re-established without significant expenditures. The new missions planned for future years will add capabilities in key areas but will not replace those that already exist in the current operating satellites. Thus, every possible effort must be made to exploit the nation's investment in these assets for continued exploration of the sun's influence throughout the solar system.

SECAS urges SEC to consider innovative ways to sustain this irreplaceable portfolio of extended missions and the science activities that utilize their observations. If NASA deems it necessary, we also support an early Senior Review to reorder priorities to make most effective use of this coordinated capability.

## 3) *Restoring a Healthy Sounding Rocket Program*

The sounding rocket program, like the Explorer program, makes crucial and productive contributions to NASA's mission of discovery and exploration. From the earliest discoveries of space exploration to those of today, sounding rockets provide a mechanism for cutting-edge science, the only access to certain regions of space, the fastest and most cost-effective access to space, and an irreplaceable opportunity for training space scientists and developing and testing instrumentation. For more than a decade, the sounding rocket operations and science budgets have been inadequate. The recent National Academy of Sciences decadal survey recognized the value of this program to the nation and recommended increasing the funding level to bring the program back to health. The President's proposed FY05 budget freezes the sounding rocket operations budget at roughly the current level for five years, losing sight of this NAS recommendation and forcing a choice between falling behind in technology and inventory or halving the flight rate. Either choice brings negative long-term consequences for space science in terms of scientific achievement, instrument development, and training of scientists and engineers required for future space exploration.

In the short term, SECAS urges that the funding for this essential infrastructure and science program be restored to the previously planned levels. In addition, SECAS supports the ongoing activity of a task force that has been created to chart the future direction of the sounding



rocket program. This task force will be consulting with stakeholders in the program to identify needed developments and the most productive path for the future.

#### 4) *Explorer AO for Missions of Opportunity*

Explorer missions are meant to provide frequent and rapid access to space for investigations to address compelling science questions. The SEC community places a very high priority on Explorer missions because they allow us to respond quickly to new scientific and technological developments and they support the future vitality of the field by providing a competitive opportunity for young experimentalists and developing groups. The major reduction in funding for the Explorer line in the proposed FY05 budget will translate into a significant delay in the development of future Explorer missions. SECAS therefore endorses the idea of releasing as soon as possible an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs). This AO, replacing this year's postponed full MIDEX AO, would potentially allow the recovery of some near-term science returns without making a large impact on the Explorer budget or out-year flight cadence. It also would provide impetus to the science community to keep considering new ideas in the upcoming period of limited opportunities. The understanding of the committee is that such an AO could be released with a relatively modest amount of effort by Headquarters staff in a reasonably short time interval (a few months). Furthermore, the committee expresses its desire that proposals tendered in response to this special opportunity be evaluated against the same quality standards already established for Explorer MOs.

#### 5) *Future Prometheus Missions*

SECAS was very interested in presentations of the Prometheus Project and Solar System Exploration Program by Ray Taylor and Orlando Figueroa, and we greatly appreciate additional SEC representation on the Prometheus MOWG, as suggested in our previous letter (November 11, 2003). SECAS continues to be extremely supportive of the developments in the Prometheus Project, which will benefit an array of notional missions that need dependable, cost-effective and/or long duration nuclear propulsion. We also applaud the plan for an upcoming workshop to consider candidate Prometheus missions to follow the Jupiter Icy Moons Orbiter (JIMO). Such a workshop begins a prioritization process that must engage all relevant divisions in the Office of Space Science. One mission that we particularly hope will receive attention is Interstellar Probe (IsP), which has consistently received the highest scientific ratings but was deferred in the NAS Decadal Survey as a high-priority flight mission because advanced propulsion developments are needed to accomplish it. IsP embodies the spirit of the President's Exploration Vision by exploring the limits of the solar system and galactic medium beyond.

#### 6) *Continued Support for Solar Probe*

SECAS reiterates its previous support for a Solar Probe mission. Solar Probe will provide the first opportunity to explore the region of space very near the Sun (to 0.02 AU), including studies of magnetic fields, coronal heating, and particle acceleration at the Sun. SECAS recommends that this mission be funded and implemented at the earliest possible opportunity. Solar Probe is clearly strongly aligned with the objective to explore the solar system outlined in the President's vision for space exploration. The strategic importance of this mission is underscored by the high rating given to Solar Probe in the most recent NAS Decadal Survey. In addition, the understanding of solar energetic particle acceleration obtained from this mission will be important for future manned missions by providing insight into one of the hazards faced by humans in space.

## Summary of SECAS Findings

1) *SEC and the Presidential Vision for Exploration*

**Issue:** Based on the President's proposed FY05 budget allocations, SECAS is concerned about the future of the SEC science enterprise.

**Background:** A vital program of scientific exploration is needed both to support human exploration and to advance our knowledge of space and the fundamental processes that operate throughout the solar system and beyond. The business of the SEC theme is exactly such exploration, but the President's FY05 budget request includes large reductions in the planned funding for the Solar Terrestrial Probes line, the Explorer line, the Sounding Rocket and Research and Analysis programs, and Mission Operations. We believe that this budget will lead to shortfalls in scientific progress, lack of synergy between the program elements, missed opportunities, and deterioration of the research base.

**Subcommittee recommendation:** SECAS urges NASA and SEC to firmly maintain NASA's longstanding commitment to understand the space environment by supporting a robust SEC program, including in particular the foundational STP line. Therefore, we recommend that budget priorities be reexamined and that the essential STP line be restored to its carefully planned and integrated schedule.

2) *Operating Missions: A Distributed SEC Observatory*

**Issue:** Budgetary impacts to the MO&DA, Supporting Research and Technology, and Guest Investigator programs threaten to result in the loss of significant key elements of the unique flotilla of existing satellites at a time of increasing need to understand the effects of solar variability throughout the solar system.

**Background:** The fourteen currently operating satellites of the Sun-Earth Connection Division span the solar system from the near-solar interplanetary medium to the edge of the Heliosphere, and near Earth from the top of the atmosphere to the top of GeoSpace. This fleet of spacecraft is unprecedented in the quality and breadth of data being gathered, returned, and analyzed, enabling for the first time the pursuit of a complete picture of the sun and its relationship to the planetary system. The scientific value of the fleet cannot be overemphasized. Once lost these capabilities cannot be re-established without significant expenditures. Every possible effort must be made to exploit the nation's investment in these assets for continued exploration of the sun's influence throughout the solar system.

**Subcommittee recommendation:** SECAS urges SEC to consider innovative ways to sustain this irreplaceable portfolio of extended missions and the science activities that utilize their observations. If NASA deems it necessary, we also support an early Senior Review to reorder priorities to make most effective use of this coordinated capability.

3) *Restoring a Healthy Sounding Rocket Program*

**Issue:** The President's proposed FY05 budget freezes the sounding rocket operations budget at roughly the current level for five years, bringing negative long-term consequences for space science in terms of scientific achievement, instrument development, and training of scientists and engineers required for future space exploration.

**Background:** The sub-orbital program provides an essential mechanism for cutting-edge science, the only access to certain regions of space, the fastest access to space, and an irreplaceable opportunity for training space scientists and developing and testing instrumentation. For more than a decade, the sounding rocket operations and science budgets have been inadequate. The recent National Academy of Sciences decadal survey recognized the value of this program to the nation and recommended increasing the funding level to bring the program back to health. However, the recently proposed FY05 budget would make this dire situation even worse, forcing a choice between falling behind in technology and inventory or halving the flight rate.

**Subcommittee recommendation:** SECAS has on several occasions expressed its support for a strong sounding rocket program and now urges that the funding for this essential infrastructure and science program be restored to the previously planned levels. In addition, SECAS supports the ongoing activity of a task force to chart the future direction of the sounding rocket program, including consultations with stakeholders to identify needed developments and the most productive path for the future.

#### 4) *Explorer AO for Missions of Opportunity*

**Issue:** The major reduction in funding for the Explorer line in the proposed FY05 budget will translate into a significant delay in the development of future Explorer missions. Some near-term science return could be recovered by issuance of an Explorer AO soliciting only Missions of Opportunity.

**Background:** Explorer missions are meant to provide frequent and rapid access to space for investigations to address compelling science questions. In the face of major proposed cuts to the Explorer budget, the release of an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs) would potentially allow the recovery of some near-term science returns without making a large impact on the Explorer budget or out-year flight cadence. It also would provide impetus to the science community to keep considering new ideas in the upcoming period of limited opportunities.

**Subcommittee recommendation:** SECAS endorses the idea of releasing as soon as possible an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs). Furthermore, the committee expresses its desire that proposals tendered in response to this special opportunity be evaluated against the same quality standards already established for Explorer MOs.

#### 5) *Future Prometheus Missions*

**Issue:** There is continued SEC interest in the Prometheus program and mission concepts enabled by it.

**Background:** SECAS heard presentations of the Prometheus Project and Solar System Exploration Program by Ray Taylor and Orlando Figueroa, and we greatly appreciate additional SEC representation on the Prometheus MOWG, as suggested in our previous letter (Nov 11, 2003). We were pleased to hear of plans for an upcoming workshop to consider candidate Prometheus missions to follow the Jupiter Icy Moons Orbiter (JIMO). Such a workshop begins a prioritization process that must engage all relevant divisions in the Office of Space Science. One mission that we particularly hope will receive attention is Interstellar Probe (IsP).

**Subcommittee recommendation:** We continue to be supportive of the Prometheus Project, and we applaud plans for a post-JIMO mission candidate workshop, where we urge consideration be given to the merits of the Interstellar Probe mission.

#### 6) *Continued Support for Solar Probe*

**Issue:** SECAS strongly endorses the Solar Probe mission to explore the Sun. This mission is well-aligned with the President's goal of solar system exploration.

**Background:** Planning for the Solar Probe mission has been ongoing for more than 20 years. Despite the compelling nature of studying the central object of the solar system, funding for a flight opportunity has not been found. The basic science is important for our understanding of processes at the Sun and in the solar system, some of which lead to hazards for humans in space.

**Subcommittee recommendation:** SECAS recommends that the Solar Probe mission be funded at the earliest possible opportunity.

**AGENDA - SECAS - MARCH 10-12, 2004**  
**NASA HEADQUARTERS – 9H40**

**WEDNESDAY, 10 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Welcome	Michelle Thomsen
0840	Prefatory remarks	Dick Fisher
0900	New space policy, budget, OSS priorities	Ed Weiler
1000	Break	
1015	New space policy, budget, SEC perspective	Dick Fisher
1115	Solar System Exploration	Orlando Figueroa

1200	Break for lunch	
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1315	MOWG reports SH Geospace LWS	Dana Longcope Jim Clemmons Dan Baker
1400	FY05 Budget Impact on the Operating Missions	Chuck Holmes
1430	Explorer Program	Paul Hertz
1500	Explorer Program Discussion	Committee
1530	Break	
1545	JIMO and Prometheus, Code T	Ray Taylor
1615	Sounding Rocket Operations	Mary Mellott
1645	Discussion	Committee
1730	Adjourn	

**THURSDAY, 11 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Update on previous SECAS findings	Dick Fisher/Barbara Giles
0845	Summary of Missions in Development/Operation	Chuck Gay
0900	Roadmap/2006 Strategic Plan 2006 Process (30min) Insights from the 2003 Process (30 min) Update on Status of Roadmap Missions (20 min) Discussion (25 min)	Marc Allen Fuselier/Spence Neil Murphy Committee
1045	Break	
1100	Discipline Scientist Reports (10 min each) GEC – Phil Richards Solar Orbiter – Todd Hoeksema LWS Geospace Missions – Barbara Giles Magnetosphere Constellation – Bill Peterson Discussion on Panel Review Issues	

1200	Catered lunch in HQ 9H40/Science presentation Marty Mlynczak (NASA/LARC): The Solar Storms of 2002 and 2003: Upper Atmosphere Response and Speculations on Their Influence on Climate	
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THURSDAY, 11 MARCH 2004 ... continued

1345	LWS	
	IRT/Non-Advocate Review	Dana Brewer
	Update (inc. Solar Probe), Actions on previous findings	Lika Guhathakurta
	ILWS	Lika Guhathakurta
1500	Break	
1515	Discipline Scientist Roundtable	
1545	Committee Discussion and Writing Assignments	Committee
1700	Adjourn	

**FRIDAY, 12 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Committee Writing Time	
0930	Review Findings	
1030	Break	
1045	Review Findings with Dick Fisher	
1200	Adjourn	

END OF MEETING

**Letter from the Chair, Structure and Evolution of the Universe Subcommittee,  
to the Chair, Space Science Advisory Committee**

March 17, 2004

Dr. Andrew Christensen, Chair  
Space Science Advisory Committee

Dear Andy,

The Structure and Evolution of the Universe Subcommittee (SEUS) met in public session at the Inn and Conference Center of the University of Maryland on 24-25 February 2004. About half of the time was spent in joint session with the Origins Subcommittee (OS). All current members of the SEUS were present except for Dr. Joel Bregman. As you know, all material presented to the subcommittee may be found on the SEUS website:

<http://spacescience.nasa.gov/admin/divisions/sz/SEUS0402/>.

**SEU THEME AND BEYOND EINSTEIN UPDATE**

The SEUS received an update from Dr. Paul Hertz, Theme Scientist, who gave a thematic overview of the budget and other Structure and Evolution of the Universe (SEU) matters. Dr. Anne Kinney, Director of the Astronomy and Physics (A&P) Division, presented an overview of A&P activities. Dr. Ed Weiler, Associate Administrator, discoursed on Space Science in the context of the President's Renewed Spirit of Discovery.

The newly announced Presidential vision would have a huge impact on SEU. The proposed FY05 budget supports the President's vision for space exploration. The space-science budget will increase by 4% in the coming year and 40% over four years. Four space-science themes are considered part of the exploration budget: Astronomical Search for Origins, Solar System Exploration, Mars Exploration, and Lunar Exploration. Structure and Evolution of the Universe is not part of the exploration vision.

As a result, the SEU budget outlook is grim. There have been delays in LISA and Constellation-X, the two strategic missions of Beyond Einstein, and elimination of any funding for Einstein Probes for at least 5 years. The only bright spot is that some additional funds have been made available for Gravity Probe B (GP-B), the Gamma-ray Large Area Space Telescope (GLAST), and Swift. Also, Research and Analysis (R&A) and Chandra have not been impacted adversely during FY04-FY05, remaining roughly the same, with a small inflationary increase (1%) for R&A. Five-year budget projections indicate minor decreases in the near-term, with a late upturn to support the Laser Interferometer Space Antenna (LISA) launch.

The reduction in the FY05-09 budget requires serious replanning. For LISA, NASA must slow down planned work to match the budget and to identify resource mismatches with ESA. Con-X has had a significant budget decrease. An opportunity has arisen to internationalize Con-X as a means of realizing the mission more quickly and discussions will begin with potential international partners to address this issue. The Einstein Probe mission concept studies are moving forward, as the science is still compelling and should continue to be advocated. The Beyond Einstein (BE) Education/Public Outreach (E/PO) will continue with a concentration on LISA in the near term.

***The science goals of Beyond Einstein--- probing the edge of time at the big bang, the edge of spacetime in black holes, and the mysterious dark energy accelerating the expansion of the universe, are among the most exciting topics in all of science today. The consensus of***

*experts validates the primacy of these goals, as expressed in several reports of the National Academy of Sciences and the strategic plans of both NASA's Space Science Enterprise Roadmap, the DOE in the High Energy Physics HEPAP Bagger-Barish report, as well as the DOE Office of Science Facilities Plan. The Beyond Einstein initiative explores some of humanity's deepest questions about the beginnings and ends of all of space and time. For the first time these questions can be answered, using tools and technologies of space science that only NASA can command.*

*These are missions that should be done, not because of the Exploration Initiative, and not despite the Exploration Initiative. They should be done because they will answer profound questions about the origin of the universe in the big bang, the destiny of the universe as determined by dark energy, and the fundamental nature of space and time as probed near the horizon of a black hole. We recommend that these programs be restored to the highest priority, reflecting their scientific importance and NASA's unique role.*

*We applaud the significant strides already taken in Beyond Einstein, including mission concept studies, and the remarkable technical advances in both LISA and Constellation-X. We suggest that progress on LISA and Constellation-X, the flagship missions of Beyond Einstein, be accelerated as much as possible. We unanimously endorse Einstein Probes as a top priority to receive new funding. JDEM requires particular attention because of its synergy with DOE strategic plans. We endorse the immediate formation of a JDEM Science Definition Team to solidify a consensus among the science community on instrument science requirements.*

### **EDUCATION AND PUBLIC OUTREACH**

SEUS heard reports on an impressive variety of SEU E/PO activities by the SEU Forum and the Beyond Einstein office. Mr. Roy Gould, Director of the SEU Forum, presented some take-home messages on SEU E/PO activities. There is very strong public interest in the SEU theme, as evidenced by presented quotations from participants in recent E/PO programs, and the Einstein centennial will provide further leverage to build on this interest. The goal is to reach a diverse audience in the pre-college population, and to supplement the dearth of astronomical knowledge possessed by elementary school Earth-science teachers. The Cosmic Questions National Exhibition is on tour through at least 2005, and it is a showcase for SEU science. It will have attracted 1 million visitors after its current venue. The SEU Forum has redone its website to reflect its focus on the Beyond Einstein theme. There is also an opportunity to reach the many amateur astronomers in the US, who typically do not have a strong interest in SEU science. The limiting factor in the classroom teaching of Big Bang theory is lack of professional development. Student interest in Big Bang cosmology is identified as high. Priorities are to develop the SEU story and unify with the other science themes, and provide students with better tools for study.

Mr. Paul DeMinco, SEU Theme Manager at GSFC, presented a summary of planning for E/PO in the BE program. The results of an external review of OSS education programs provided a starting point for analysis. The review suggested that teachers have trouble getting the data they need to present BE concepts. The science message rather than the mission must be the obvious focus. There are also challenges peculiar to teaching BE physics that need to be addressed. A Framework Initiative has been undertaken to identify issues by grade level (K-12). The AAAS has a project 2061 Atlas that reflects the desired ideas that would be expected in 2061. The Atlas is weak in presenting SEU science and there is an opportunity to rectify this. A Fall 2003 workshop identified middle and high school science as good targets. National science standards are not followed consistently among states. The OSS Framework will provide guidelines to deal with this inconsistency. Another target of opportunity is the two-year college, because many teachers begin their education there. There is a potential to collaborate with the National Science Teacher's Association and the National Council of Teachers in Mathematics in DC. Current

initiatives with DOE include creation of a sustained collaboration in both the education and public outreach area. A science symposium to celebrate the Einstein centennial is under consideration. The theme is also collaborating with the American Association of Physics Teachers (AAPT) and NASA's Navigator Program, leveraging existing efforts with community colleges and the AAPT. A new tool in outreach includes high-definition animation. Future activities are additional workshops, and development of a long-term plan that flows with the results of the Framework Initiative and the availability of funding.

*Noticeably absent, however, was a close connection with specific SEU programs and missions. We sense that there is a lack of coordination, overview, and overarching goals. What is the purpose of SEU's E/PO activity? Is it to excite a new generation of scientists, to generate public support, or to improve science education? In particular, how do the various activities further these goals? It is, we recognize, a challenging task to tie together and coordinate all these diverse activities. Nevertheless, it might make sense for either the SEU Forum or the Beyond Einstein office to take on the responsibility of coordinating SEU E/PO activities. There is a near-term opportunity for highlighting SEU's activities via the Einstein Centennial, and we would appreciate hearing by the summer about ideas for capitalizing on this opportunity and tying SEU's E/PO activities together.*

### **BALLOONS AND SOUNDING ROCKETS**

Dr. Vernon Jones presented an update on the balloon program, which provides low-cost access to space at an altitude of 120K feet, and niche science investigations that can be done above 99.5% of the atmosphere. The program also makes possible observatory-class payloads with advanced technologies and large aperture mass, technology development and flight validation for future space missions, and cutting edge science in 10-20 day missions. The program must increase its flight rate; it has been decreasing linearly over the past 4 decades, although flight durations have been increasing. There is insufficient funding for building payloads and for operations. 40M-cubic-foot balloons were introduced in 2004. The ANITA experiment for neutrino-based observations was described. The program is at a crossroads. Changes since the Columbia accident justify a new plan for balloons. The plan is to focus a strategic balloon plan on both payloads and operations, increase the number of conventional and long-duration balloon (LDB) flights, and complete the development and demonstration of ultra-long duration balloon flights (ULDB). "Big 60" flights will enable UV observations. Flights in Antarctica are limited by an insufficient NASA budget, inadequate logistics support from the NSF/Office of Polar Programs for more than 2 flights per year, inherent limitation of austral summer length, the need to recover balloon carcasses to meet EPA constraints, and self-imposed limitations due to operations policy. Additional resources are needed from NASA/OSS. A modest budget line could double or triple the LDB flight rate. More logistics support is needed from NSF/OPP. Resources are also needed to improve the recovery process, such as an additional aircraft. Procedural changes in operations could increase efficiency. One option is to let balloons "fly till they die" if recovery is not required for a follow-on science flight, (but there may be environmental concerns for this option). The strategic planning process is under way, with an Antarctica workshop planned for May 2004. The critical question is: Is there sufficient quality science available for justifying new payloads?

Plans for the ULDB Program Recovery were presented by David Gregory, Assistant Chief, Balloon Program Office. After a failure to deploy and maintain pressure of a balloon during a test flight at Alice Springs in 2003, some modifications in the design and fabric process have been made, including strengthening tendons that bear the load. Five test flights will be conducted this year. A 6 million cubic foot (MCF) balloon will be taken to Australia in December 2004, with a 21 MCF balloon to be flown in December 2005. Other studies are ongoing to



mitigate clefting problems with balloon materials. Antarctica balloon operations were briefly touched on. A new facility is planned for completion by October 2005, with a two-payload (perhaps three) support capability. A new launch vehicle has also been introduced.

Dr. Philippe Crane introduced a briefing on the sounding rocket program, an important part of the R&A program. Almost all flying satellites have detectors that were built and flown either in the sounding rocket or the balloon programs. Dr. Mary Mellott, Sounding Rocket Program Scientist, announced that a significant new capability at Wallops can be developed in very high-altitude, long hang-time rockets. The new budget has adversely impacted the development of this new capability in sounding rockets. Dr. Mellott asked for SEUS advice on rebalancing the budget to support the High-Altitude Sounding Rocket (HASR) program on its intrinsic merits. Dr. Philip Eberspacher continued the presentation. The sounding rocket program offers unique opportunities for low-cost, fast-turnaround, focused scientific research, platforms in space for testing and developing new technology, and hands-on training for young researchers. A typical flight profile is about 700 km altitude and 1000 km range. Vehicles include the Terrier Malemute, Nike Orion, Terrier Orion, and Black Brants IX and XI. Experiments span the disciplines from astronomy through plasma physics, air sampling, and atmospheric entry vehicles. The program leverages multiple sources (e.g., Navy) for funding. The HASR is the next generation rocket, providing a 1000-lb total payload (700-lb science instrument), 50-inch fairing, 3400-km apogee, and 40-minute observation time. The cost per mission was estimated at \$5M or less per vehicle, plus operations (\$10M total). A tentative plan was to launch one HASR every one or two years while maintaining the smaller rocket program. This plan is not supported by new budget projections.

***The SEUS applauds the effort to integrate the goals of the balloon program into the overall strategic planning process. In this context, we request a presentation at our November meeting that would supply a crisp case for this program as it pertains to the upcoming revision of the SEU Roadmap. We thank NASA for maintaining the viability of the balloon capability so that it can be incorporated into the Roadmap. Finally, we look forward to hearing about a successful demonstration of the Ultra Long Duration Balloon capability at a future meeting.***

***We recognize the rocket program as a valuable resource in training the next generation of scientists and engineers, and in testing new detector technologies for space flight. However, we would like to have additional information in the following areas:***

- 1. What is the specific role of the rocket program in supporting the development of technologies for future SEU missions and in producing SEU science?***
- 2. What are the criteria that are used to evaluate the strategic role of the rocket program?***
- 3. How would the new HASR change the number of launches per year? How would priorities to use the HASR be traded off vs. a larger number of smaller rocket launches?***
- 4. What SEU science would be enabled by the proposed HASR vs. smaller rockets and vs. balloon payloads?***

## **RESEARCH AND ANALYSIS PROGRAM**

Dr. Jeffrey Hayes provided an update on R&A activities, including Theory, GO and Archives. Traditional elements of the program are ultraviolet (UV)/optical detectors, infrared (IR) submillimeter, origins of solar systems, high-energy astrophysics, balloons, sounding rockets. Data analysis and theory elements include ADP/LTSA, ATP, and BE Foundation Science (BEFS). BEFS contains all elements, not just Theory. The ROSS schedule deadlines were presented. Delayed grant notifications in OS/SS have been due to budget uncertainties and

understaffing problems. The A&P policy for GO funding programs is to support users of NASA assets in the analysis of their data- the mission set includes HST, Spitzer, and Chandra. FY04 funding levels for various continuing and new awards were presented. The total is \$164M for FY04. Senior Review guidance largely determines the distribution of dollars and the quality of the proposals. There is some flexibility to rebalance the distribution once the budget is in place in response to quality of proposals as determined by peer review. Operations are not part of this budget; it also does not include legacy teams. A&P has responded to calls for more Theory support, and added new funding to HST, CXO, SST, and BE (about \$13M, in full-cost accounting dollars). This represents a significant increase in Theory funding. In addition, there are other sources of Theory funding scattered throughout OS and SEU. Skepticism was expressed about the full amount of funding, impacted in part by the costs for NASA civil servants. The quality of the grants (in terms of proportion one-year versus three-year grants) was debated. The Decadal Survey recommendation was to associate Theory programs with missions at appropriate stages of development, and NASA has answered this recommendation (e.g., in early BE and TPF). A breakdown of funding was presented. FY04 funding levels for the Archives is about \$25M. The community does not fully understand that Theory is distributed so broadly among programs. ROSS has been rewritten to deal with this question- it includes an explicit but conservative representation of new monies available each year. Dr. Richstone remarked that Theory has been rated so highly because Theory papers have been giving extraordinary bang for the buck, in extending the value of missions and providing a pathway for future missions.

***The R&A program supports NASA's strategic plan through research and data analysis, theoretical studies, and guest observer programs. Continued support of R&A is vital to a healthy science program, and we applaud the increased ATP and mission-related theory support. This satisfies a concern of the 2000 Decadal Survey to increase funding for astrophysical theory, and we encourage continued support for Beyond Einstein Foundation Science. The Subcommittee expressed an interest, however, to understand the reasons for the differences between analysis funding for the different Great Observatory programs, e.g., we would like to understand the mismatch between Chandra, HST, and Spitzer.***

### HST

The SEUS was briefed on the decision to cancel the Hubble Space Telescope servicing mission SM4.

***We note that the Hubble Space Telescope has in the past made key contributions to SEU science and we are very concerned by the loss of the future unique and compelling SEU science which would have been enabled by SM4. We commend and endorse the efforts which are being undertaken to extend the Hubble Space Telescope's operational life without additional servicing and to maximize the mission's science return. We encourage NASA to continue to explore options and alternatives to recover this regrettable loss of science.***

### TECHNOLOGY PLANNING

Dr. Melvin Montemerlo presented the results of a request for a listing of enabling technologies for Code S/Z, and technology development strategies. The documents are the *A&P Technology Development Strategies*, and the *A&P Enabling Technologies For Future Missions/SEU and OS Themes* (both distributed). These surveys should help the roadmappers take the technology requirements into account as planning progresses. These documents will not be discriminators for

selection. The technologies called out will be high priority, but technologies not included will not be rejected out of hand. It is intended to be a helpful document and not a limiting or threatening document. The Spacecraft Technology Program History (began as Code R) was briefly reviewed, noting that changes in Code identification have been numerous. Dr. Montemerlo requested feedback from OS and SEUS on the accuracy and utility of the survey results.

The newly formulated Code T plans include a contractor review of all Code R Space Technology tasks in early March 2004. Code T will then determine what to continue- the timing of this decision is not known. For the first time, the technology program is in an Office that is responsible for its own projects, including vehicles and missions. Code T is not an Institutional Program Office and does not have responsibility for Centers. Boundaries have not yet been defined. Code S and T have divided responsibilities for the lunar mission, for instance. Restructuring is important for long-term science; these concerns should be taken to the NAC.

***Committee members endorsed the survey effort and encouraged Dr. Montemerlo to consider information technology/software needs.***

***The SEUS was pleased by the systematic approach to identifying the technology needs of Astronomy & Physics missions shown by the draft "Enabling Technologies..." report presented by Mel Montemerlo.***

***Detectors, coolers, low mass optics, vibration-free structures and precision formation flying are required for future A&P missions and need to be developed to enable progress in space science.***

***The SEUS would like an update about the interface between Code S and the new Code T technology development program under the new organizational structure.***

### **AAAC REPORT**

Dr. Hertz presented a synopsis report from the AAAC, a joint NASA/NSF advisory committee on astronomy. Robert Gehrz is the outgoing Chair and Garth Illingworth is the Chair-elect. AAAC endorsed JWST, expressed concern for BE and had a lively debate about SM-4. AAAC also endorsed the astronomy and astrophysics supported activities in the DOE Office of High Energy Physics. An x-ray astronomer was suggested for the AAAC. There may be a need for a gravitational wave scientist, however, as there are overlaps between NSF and NASA in this area. The AAAC does implicitly endorse the Inflation Probe because of its support for the future of CMB research roadmap. The SM-4 discussion is still under way, but the AAAC is expected to point out the science losses incurred by the loss of the mission.

### **SAWG REPORT**

There were no comments. The report is available on the Web. A copy is attached.

### **OTHER PRESENTATIONS**

Dr. Harvey Tananbaum, Director of the Chandra X-Ray Center, presented recent science results from Chandra. SEUS would like to thank Dr. Tananbaum for the excellent presentation and congratulates him and the Chandra team for the continued success of the mission.

Dr. Bryant Cramer, LISA Project Manager, presented an update on the status of the LISA mission. Program Manager Dr. Elizabeth Citrin presented an update on Constellation-X (Con-X). SEUS recognizes substantial progress on both LISA and Con-X in spite of budget problems.

Respectively submitted on behalf of the SEUS,

Rocky Kolb

3/17/2004

TO: **Andrew Christensen, Chair, Space Science Advisory Committee**

FROM: **Jonathan I. Lunine, Chair, Solar System Exploration Subcommittee**

SUBJECT: **Solar System Exploration Subcommittee Meeting**

The Solar System Exploration Subcommittee (SSES) of the Space Science Advisory Committee (SScAC) met February 25-26, 2004 at the University of Arizona in Tucson. The purpose of this memorandum is to summarize the findings of that meeting and ask SScAC to consider them and transmit its recommendations to Mr. Orlando Figueroa, Director of the Solar System Exploration.

#### Presidential Initiative.

The President of the United States has set in motion a new initiative to revitalize human and robotic exploration of the solar system with a near term focus on returning humans to the Moon and a longer term goal involving human exploration of Mars. The rationale for combined robotic and human exploration of the Moon and Mars is consistent with SSED's preexisting themes of understanding the history of the solar system and the evolution of life in it. SSES is very pleased that significant parts of the program will be based on peer-reviewed scientific priorities. SSED will manage a new program of robotic lunar missions as well as an expanded suite of Mars missions. Also, while managing lunar missions following the priorities established by the Office of Exploration, SSED will use its expertise to achieve outstanding new science wherever possible.

SSES welcomes the opportunities afforded by an expanded program of solar system exploration; however, we have some concerns. This expanded program poses challenges to SSED which include providing experienced management and technical teams on short timescales, and interacting effectively with a customer organization, Code T, that is motivated by goals other than science. Some have expressed concern that Initiative priorities may distort ongoing SSED programs such as Discovery or New Frontiers. Furthermore, a mandated freeze on basic R&A programs across SSED interrupts the trend of three years of better-than-inflationary increases, and could adversely impact the scientific results obtained from flight programs.

SSES is extremely pleased that all Solar System Exploration programs are once again unified under the common direction of Orlando Figueroa, a structure we believe makes sense given the nature of the endeavor. Moreover, SSES is happy to hear that SSED is committed to preserving ongoing peer-reviewed programs, such as Discovery and New Frontiers, without impact from Presidential Initiative activities. We recommend that appropriate staffing at all levels below the SSED Director be pursued aggressively, and that experienced engineers and scientists be recruited to create an organization capable of responding to the challenges brought by the new Initiative.

#### Jupiter Icy Moons Orbiter

We applaud the work of the Jupiter Icy Moons Orbiter (JIMO) Science Definition Team (SDT) in pulling together an excellent set of goals, objectives, and measurements for the icy Galilean satellites in the greater context of the jovian system. The SDT results promise a rich science return from JIMO. We are concerned that the splitting of Prometheus/JIMO between Code S and

T, with the science remaining in S, will make it difficult to keep the science priorities for JIMO in the forefront as Code T develops the relevant flight technologies. In particular, requirements of the Exploration Initiative might lead to power and flight technologies that cannot fulfill the JIMO science goals. The SSES recommends establishment of clear and open communication channels between Code S and the new Code T, where the Prometheus project resides, in order to ensure that the science potential of JIMO is fulfilled.

The SSES is strongly concerned about the launch and arrival delays for JIMO. A launch in approximately 2015 and arrival at Europa in approximately 2023 implies a 20 year hiatus in Europa exploration. This gap is particularly troubling because Europa is an extremely high priority target because of its astrobiological potential. The consensus of the committee is that any further delays must be avoided in the mission development.

### Discovery

Budget and schedule problems with current Discovery missions (Messenger, Deep Impact, and Dawn) continue to pose a threat to the integrity of the program by 1) forcing a longer interval between opportunities and 2) diluting the emphasis on focused, costconstrained mission concepts. The SSES applauds the recent progress made by the SSED Director in establishing greater programmatic control over Discovery missions, and creating a dedicated program office at JPL to more carefully track and assess technical progress during mission development. These steps, in conjunction with a continued improvement in communications between scientific and technical/management /cost review panels, will help future selected missions to adhere to the original Discovery Program mandate. The SSES continues to support a strong policy of cancellation for missions that cannot maintain their proposed cost and schedule.

SSES is very pleased that the Discovery program has demonstrated a TMC-Science review structure that allows exchange of limited but appropriate amounts of information between the two panels by adding a technical member to the science panel. This process permits both panels to understand each other's approaches and concerns while not jeopardizing the principle of independent reviews. SSES recommends that this process be employed in other programs.

### New Horizons

The New Horizons (NH) mission will provide the first exploration of the outermost bodies of the solar system, particularly their volatile and organic components, and addresses two of the four central themes highlighted in the 2003 Planetary Decadal Survey. NH is currently on track for a January 2006 launch, with a mid-2015 encounter with the Pluto-Charon system, followed a few years later by the flyby of a Kuiper Belt Object (KBO). However, recent delays in the fabrication of the radioisotopic power system required for the New Horizons mission may result in inadequate power available near the end of mission, just when the KBO flyby is to occur. This would likely limit mission operations, and so is a concern to SSES, as the Planetary Decadal Survey ranked the KBO flyby as its highest science priority. SSES strongly encourages efforts to protect the current power margins from further erosion.

Also of concern, as with any mission using nuclear materials on a relatively new launch vehicle, are (1) the lengthy launch approval process and (2) the public perception of a launch risk. Given pilot efforts in the community to better educate the public on these issues, SSES encourages NASA to coordinate its own E/PO program with those of non-NASA agency E/PO programs so as to best explain the role of RTGs in outer solar system exploration and how launch risks are analyzed and mitigated.

### Mars Exploration

The SSES congratulates JPL, NASA HQ, and the university and industry science and engineering teams of the MER mission for the outstanding success achieved thus far by the Spirit and Opportunity rovers. The Mars Exploration Rover (MER) mission is historically unprecedented. There has never before been a robotic rover—let alone two at any one time-- with extended mobility on a planetary body. The mission goal to provide ground-breaking data bearing on the history of water on Mars has been fulfilled with the announcement of evaporate deposits at Meridiani Planum, and additional profound discoveries are likely to come. The immediate release of images and the depth and accessibility of the website have captured and engaged the public's interest at a level never previously experienced by NASA or any other government agency (over 7 billion hits to NASA and Mars sites since Jan. 3, over 56 million unique visitors). The ready access to exciting mission data through the internet provides a model for future missions. The SSES recognizes this success would not have been possible without the valuable contribution of the Mars Global Surveyor and Mars Odyssey orbiters in maximizing the scientific and data relay opportunities. This underscores the importance of dedicated communications satellites (such as the planned MTO) to support future Mars exploration missions.

Preventing both forward and backward biological contamination is an essential component of NASA's solar system exploration program. The cost and effectiveness of planetary protection for the Mars Science Laboratory (MSL), including (but not limited to) sterilization to avoid incubation in liquid water melted by the spacecraft from permafrost, is a significant issue. Current cost estimates are very high for planetary protection. Given the astrobiological focus of MSL and its possible high-latitude destination, the SSES considers that resolving these issues is critical. We are pleased that NASA is aggressively trying to understand and reduce the cost of planetary protection. SSES will monitor this issue closely in coming meetings.

The Next Decade plan prepared by the Mars Science Program Synthesis Group (MSPSG) proposes four “pathways” for Mars exploration, in which the particular sequence of missions would change in response to major discoveries by earlier missions. In its previous meeting, the SSES expressed concern on two issues related to this “pathways” plan, 1) the scope of Mars exploration may become too narrow if limited to one particular “pathway” and (2) there is significant risk that targeted sites (for sample return or a robotic laboratory) may prove to be nonproductive. . The committee will follow this second issue closely in upcoming meetings, as well as the impact of the Presidential Initiative on the pathways concept. In continuing our evaluation of these issues, the committee concludes that the “pathways” plan represents a reasonable approach towards Mars exploration as long as the program does not get locked into a particular pathway. The SSES reiterates its previous recommendation that AOs for future Mars Scout missions should not dictate specific science roles in particular pathways.

### Entry probes

Entry Probes are essential for in situ sampling of the deep atmospheres of Venus and the giant planets. There are several cases in which important results from remote sensing were found to be in error once in situ measurements were obtained from entry probes. There is concern in the community that the ability to perform probe missions is at risk of being lost – heat shield materials & testing facilities are no longer available and experts are retiring with no one trained to replace them. We ask that NASA examine the costs associated with production and testing of new heat shield materials, in the context of potential exploration plans involving probes.

Planetary Data System

The committee notes the critical importance of the Planetary Data System (PDS) in preserving the hard-won data from planetary missions and providing access to those data, and the committee welcomes the critical re-examination of PDS structure and processes that is under way. We draw your attention to several specific issues

1. Interface with sample curation facilities – The first samples to be returned to Earth in decades will arrive later this year from *Genesis* and in 2006 from *Stardust*. The issue is that planetary samples require not only curation at specialized facilities but also detailed documentation in order to be usable for scientific analysis. SSES urges PDS to develop interfaces with the NASA sample curation facilities to clarify roles and responsibilities in regard to sample documentation datasets and to enable access to the larger planetary science and external communities.
2. Late deliveries to PDS and budget issues – SSES is aware that some missions fail to meet PDS delivery deadlines for datasets and/or documentation. In some cases, these failures result from conscious choices on the part of mission management responding to schedule and budget pressures, but in other cases there were evidently factors beyond the control of the mission that led to funding shortfalls for archiving. The Committee is concerned that permanent loss to science from archiving failures may result from relatively minor funding issues.
3. Usability - The PDS nodes are encouraged to develop and engage in E/PO efforts that are consistent with and support the overall OSS E/PO program. It is a concern of the SSES that using PDS products and planetary data within the classroom environment has been difficult for teachers and has diminished usage of these materials. The SSES suggests that new PDS-related EPO proposals endeavor to align with the NASA Education guidelines and goals and that a review board consisting of Code S E/PO specialists and master K-12 teachers be utilized to insure the usability and feasibility of proposed EPO products so they may be validated before they are produced.
4. Peer review – At present, only PDS subjects datasets to an external science peer review process. SSES recognizes that this peer review process is expensive, both for PDS and for the science community, and encourages a reassessment of scope and process. Other communities rely less on peer review by working scientists and more on archiving experts. However, the appropriate balance between review by archivists and peer review may vary from field to field. PDS is aware of this issue and we encourage them to review the current situation, and report back to SSES at a future meeting.

With best regards,

Jonathan I. Lunine  
Chair, Solar System Exploration Subcommittee



**Letter from the Chair, Space Science Advisory Committee,  
to the Associate Administrator, Space Science**

Dr. Edward Weiler  
Associate Administrator for Space Science  
NASA Headquarters  
Washington, DC 20546

April 15, 2004

Dear Dr. Weiler,

The Space Science Advisory Committee (SScAC) met in public session March 25-26, 2004 at the Grand Hyatt Hotel in Washington, DC. The President's Exploration Policy created the overall context to the meeting and dominated our discussions. We are grateful to members of your staff and others that spent their valuable time with us. We hope that our deliberations and recommendations will be a positive contribution to the affairs of OSS and NASA.

The meeting was the final meeting for two of our members, Roderick Heelis and Paul Knappenberger. Their terms will expire prior to our next scheduled meeting in July. We appreciate the great service they have provided to our community. All members of the committee were in attendance except for the unavoidable absence of David Deamer. As we have come to expect, the meeting ran flawlessly under the direction of Marc Allen, Marian Norris and Ana Wilson.

The first day of the two day meeting was devoted to the Division and Subcommittee reports. Anne Kinney, Jim Garvin, Jay Bergstrahl and Richard Fisher summarized the issues in their respective divisions. Rocky Kolb, Dave Spergel, Jonathan Lunine and Michelle Thomsen reviewed the activities and results of the corresponding subcommittee meetings. The second day Marc Allen presented the plans for the strategic/roadmap planning process. Richard Fisher presented information of the state of the Sounding Rocket program. Admiral Steidle presented the final briefing of the day on his plans for code T. The agenda allowed time needed to respond to a request from NAC on the impacts of the Exploration Policy and to prepare detailed recommendations for OSS.

During the lunch hour on both days, we were treated to outstanding science talks. Mike Werner discussed the new results from the Spitzer telescope, the new infrared member of the great observatories, formerly SIRTf. The photographs were dazzling. On Friday, Steve Saunders discussed the evidence for liquid water on the surface of Mars using new results from the Mars rovers. Photographic and analytical evidence make a very strong case.

The committee prepared a letter for the President's Commission on Implementation of U.S. Space Exploration Policy expressing our support for a strong science component in the program. A copy of that letter is attached. In addition, the individual subcommittee reports are attached.

Sincerely

Andrew B. Christensen  
SScAC, Chair

Attachments:

SScAC Recommendations  
SECAS Report [Appendix F]  
SEUS Report [Appendix G]  
SESS Report [Appendix H]  
OS Report [Appendix E]  
Aldridge Commission Letter

**SScAC RECOMMENDATIONS**

- Over the past quarter century Space Science has been the most productive of NASA's endeavors and has transformed the agency into the primary force in national and international scientific progress. This progress has been enabled by the depth, breadth and balance of the space science program. This year's discovery that liquid water persisted on the surface of Mars, the Hubble ultra-deep field image that views infant galaxies within the first 5% of the history of the cosmos, the observation of dramatic solar activity with significant repercussions throughout the solar system, the early successes in Spitzer infrared studies from proto-planetary disks to distant galaxies, and Chandra studies of the destruction of a star by a black hole illustrate the excitement generated by this broad and compelling program. NASA should not step away from this preeminence in science through an overly narrow interpretation of the Exploration initiative. **We strongly recommend that "highest quality science" remain the guiding principle for OSS.**
- We are very pleased that the FY05 budget proposal supports Solar System Exploration, Astronomical Search for Origins, and Living with a Star. These, developed as elements of the OSS Strategic Plan, will continue to produce exciting new discoveries and represent the scientific foundation for the Exploration Initiative. The new budget is, however, leading to significant delays in implementing important missions within the broader program of scientific exploration laid out in the strategic plan, specifically, key parts of the Sun-Earth Connection and Structure and Evolution of the Universe themes. The delayed science in SEC retards the basic science upon which the LWS program is founded. The delayed science in SEU retards the tremendous advances in developing a fundamental understanding of our universe. **SScAC recommends that NASA keep science in the forefront of the Exploration initiative.**
- **SScAC supports OSS prioritization for proposed new initiatives**, specifically that Einstein Probes and Solar Probe be given highest priority, as a first step in restoring the broad vision of scientific exploration that has been a hallmark of OSS programs in the past. Einstein Probes implement the highest priority science in the "Physics of the Universe: Quarks to Cosmos" NAS report, and Solar Probe was identified as the priority large mission in the Space Physics Decadal Survey of the NAS.
- The Explorer Program has contributed fundamental science over many years and has served as a model for missions of small to moderate scale. SScAC is concerned about the status and fate of this program. **We expect to be fully briefed and have a complete and thorough discussion of Explorer issues at our next meeting.**
- Hubble Space Telescope has just completed a decade of highly successful operation. With two new instruments ready for launch, HST is poised to continue to make major contributions to astronomy in general and the Exploration Initiative in particular. NASA's decision to cancel Servicing Mission 4 will substantially and negatively impact a number of fields in Space Science in terms of new discoveries. If any form of servicing is possible, continuing Hubble science remains exciting and important. We encourage NASA to consider the broadest possible range of servicing options, with the priority being to maximize the science return from HST. If servicing is not possible, operation as long as possible is exciting and important and OSS should mitigate or recover the loss of science (including, e.g., flight of stranded instruments on other spacecraft). **SScAC recommends that OSS investigate ways to sustain the outstanding science successes of HST.** □

- Tremendous progress in our understanding of the complex interaction and relationships between elements of the Sun-Solar System, including the sun, its heliosphere, planetary magnetospheres and atmospheres, has been enabled by an existing fleet of spacecraft operating in Earth's geospace. The existence of this fleet is jeopardized by the budget cuts in the SEC MO&DA line. The satellites provide the measurements that feed the fundamental science underlying the understanding and prediction of space weather, an overriding concern of space travelers. **SScAC recommends that options to sustain this irreplaceable portfolio of missions be developed.**
- SScAC is concerned about the relationship between Codes S and T. For example, the splitting of science requirements and technology development on Prometheus/JIMO between the codes may make it a challenge to keep the science priorities for JIMO in the forefront as Code T develops the relevant flight technologies. A strong connection between Code S mission science requirements and Code T technology development plans is essential. **SScAC recommends that the relationship between Code S and the new Code T be formalized to ensure that the science potential of new technologies is fulfilled.** We also endorse the program of identifying new technology needs within Code S.
- SScAC is concerned about the apparent slip by two years in the launch target for JIMO, associated with the pace of the Prometheus program. **SScAC notes that additional slippage would put the science associated with JIMO well beyond the horizon of the current Solar System decadal survey and the Code S strategic Plan.**
- SScAC is concerned about the increasing length of time and complexity of the launch approval process for missions that use nuclear power sources. This trend could threaten our ability to explore the deep solar system and Mars. **SScAC would like to be briefed on the details of this issue in the near future.**
- The funding profile for the sounding rocket program presented to SScAC is very disturbing. It indicates that the program may collapse from lack of flight opportunities in approximately 18 months. Briefings to the SEUS regarding the balloon program also showed serious problems. Given the value of the programs, the whole of the sub-orbital program should be reexamined. It should be aligned with the science requirements in the strategic plan and prioritized according to its value to the goals of OSS. **SScAC recommends that a briefing be prepared outlining the benefits, capabilities, resource requirements and restructuring options of the sub-orbital program for consideration by the roadmap and advisory committees, including SScAC.**

The Honorable Edward C. Aldridge Jr.  
Chairman, President's Commission on  
Implementation of U.S. Space Exploration Policy  
2900 South Quincy Street  
Suite 800  
Arlington, VA 22206

April 2, 2004

RE: Comments of the NASA Space Sciences Advisory Committee

Dear Mr. Aldridge,

The President's newly articulated vision aligns many of the basic science questions asked within Office of Space Science (OSS) and the long-term goals of the human space flight program. The synergy between OSS and human space flight can strengthen the overall mission of NASA. By keeping a strong science emphasis within the exploration initiative, The Vision will provide a lasting legacy long after the flags fade and the footprints dissipate in the dust.

The OSS and the community of scientists and engineers that contribute to its success are important to the Presidents Exploration vision. They provide the scientific capital necessary to motivate, understand, explain, plan and implement the program outlined in The Vision. They provide an experience base that should inform the implementation process. The principles that have led to our success as the world's leader in space science and its popularity with the public include:

- Stress on scientific excellence, above all
- Development of scientific priorities through broad community input
- Implementation guided by Strategic Plans
- Frequent and diligent revisiting and updating of plans
- Involvement of stakeholders throughout the planning and implementation process
- Strong and effective management and oversight
- Effective communication with the public

At its recent meeting (March 25-26) in Washington D.C., The Space Sciences Advisory Committee (SScAC) examined the Presidents policy directive and the implementation and budget plans affecting the Office of Space Science (OSS). We are concerned with early signs of the erosion of these principles as NASA comes to terms with the timetable and technical difficulty of sending astronauts safely to outposts in space. Effective plans to sustain top-level science within a successful exploration program should seek to counter the inevitable pressure to reduce science in cost-constrained, technology driven programs. The relatively weak science achieved by the International Space Station and Shuttle as compared to the remarkable discoveries of the Hubble Space Telescope and Mars Exploration Rovers serve as examples to illustrate the point. We encourage you and your committee to keep the role of science as a leading element of the implementation strategy you are developing.

The SScAC would be pleased and honored to present its views to the committee directly.

Sincerely,

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